

## **REMARKS**

### **Status of Claims**

Claim 1 is amended to recite the subject matter of claims 15 and 16, which are thus canceled, and the alternative subject matters of intermediate layer materials of claim 17 and the metal oxide of claim 18.

Thus, claims 1-14 and 17-19 are presented for examination.

### **Claim Rejections - 35 USC § 112**

Claims 11-19 are rejected under 35 U.S.C. §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Regarding Claim 11, the limitation "the transition area" is stated in the fourth line of the claim. There is insufficient antecedent basis for this limitation in the claim.

In response, Applicants change "transition area" to "overlap area" for where there is antecedent basis.

Regarding Claims 12-19, the claims are dependent to one or more of the set of cancelled claims. The claims have been examined on the merits with each claim being dependent upon Claim 11.

In response, Applicants thank the Examiner for pointing out this obvious error, and have amended the claims to depend from claim 11.

Withdrawal of the rejection is respectfully requested.

### **Claim Rejections - 35 USC § 102**

Claims 11, 13-16 rejected under 35 U.S.C. §102(e) as being anticipated by Baur et al. (U.S. Pat. No. 6,868,814).

According to the Examiner, Baur et al disclose a multi-part valve possessing a valve shaft 1 and a valve plate 2 with an overlap area (1 in Figure 1). The valve plate is

connected to the shaft (col. 2, II. 57-60) with an intermediate layer (col. 3, II. 27-32) disposed in between by way of a chemical bond (diffusion).

Applicants respectfully traverse in view of the claims, as amended.

Baur et al do teach pouring a casting intermetallic compound of titanium aluminide around the end of a steel valve stem, and teach that a metallurgical joint between valve head and valve stem may be formed by fusion between the material of the valve head and the material of the valve.

Further, Baur et al further teach that, if there is an intention to deliberately avoid such a metallurgical joint, then a diffusion barrier can be applied between [head] casting material and stem. The diffusion barrier can be a molybdenum film or a molybdenum layer which is applied to the stem and prevents joining by fusion during mold filling.

In the present invention, in contrast, the intermediate layer is a layer which improves the joining by chemically bonding with the valve material, on the one hand, and with the stem material, on the other hand (paragraph [0031]).

See the present specification, paragraph [0008], which distinguishes over the state of the art as represented by Baur et al: "A material-to-material bond of this type can also be achieved purely by casting the valve plate onto the shaft. The joining behavior is however in this method dependent upon the employed materials and until now insufficient or unsatisfactory. The inventive employed intermediate layer is so designed, that it bonds both with the material of the valve shaft as well as with the material of the valve plate forming a substance bond."

In any case, claim 1 has been amended to recite:

that the valve shaft is steel.

that the valve plate is Ti-Al, and

that the valve shaft (2) in the transition area (6) is provided, prior to the casting-on, at least partially with at least one intermediate layer (8) comprised of an Ag-base alloy and/or Ni-base alloy and/or Cu-base alloy or is constituted on the basis of a metal oxide.

which subsequent to the casting-on is material-to-material bonded both to the valve shaft (2) and the valve plate (4) in the manner of a chemical bond.

Thus, where Baur et al teach an intermediate molybdenum layer for prevention of fusion following casting-on, the present invention seeks to promote fusion in a casting process, and addresses the problem of insufficient fusion by specifying the material of the shaft, the material of the valve plate, and the material of the intermediate layer.

Considering for example the method claimed in claim 1 of Baur et al, this specifies casting a titanium/aluminide material onto a steel shaft. This process would produce an overlap area (6) which comprises a steel-Ti/Al-mixture (alloy). Neither steel nor titanium-aluminide comprise Ag or Cu as alloying components, so Ag or Cu will not be found in this overlap area (6) absent specific disclosure that they came from elsewhere. Small amounts of nickel may be present in steel of the stem. However, there is no teaching in Baur et al of a Ni-base alloy intermediate layer between the steel stem and the valve plate.

In the present invention, by the specific recited intermediate layer materials, fusion layers are formed containing either silver or nickel or copper or a metal oxide, all of which would not be present in quantities in conventional metals to form an intermediate layer between the valve stem and plate.

Regarding Claims 13 and 14, according to the Examiner the overlap area can be designed to have undercuts or recesses (col. 3, ll. 5-10).

In response, Applicants submit that these dependent claims are allowable by virtue of their dependency from allowable claim 1.

Regarding Claims 15 and 16, according to the Examiner the valve plate is composed of titanium aluminide (col. 3, ll. 40-50) and the stem is made of steel (col. 3, ll. 34-36).

In response, Applicants submit that these dependent claims are allowable by virtue of their dependency from allowable (amended) claim 1.

Next, claims 11-16, and 18 are rejected under 35 U.S.C. §102(b) as being anticipated by Koike et al. (U.S. Pat. No. 5,076,866).

The reference above discloses a composite engine poppet valve comprising a valve shaft 21 and valve plate 20 joined together with an overlap area formed by material 29. The intermediate layer 29 material-to-material bonds the shaft to the plate in the manner of a chemical bond (plastically worked, col. 1, II. 52-63).

Applicants respectfully submit that Koike et al do not teach a steel shaft nor a TiAl valve. Thus, Koike et al can not anticipate the claims as presently amended.

According to the Examiner, regarding Claim 12, the intermediate layer 29 is in the form of a gradient layer in Figure 3C; regarding Claims 13 and 14, the valve shaft 21 exhibits recesses formed from extruded micro-pieces (col. 8, II. 45-55) in Figure 4A; regarding Claim 15, the valve plate is comprised of an aluminum-titanium compound (col. 1, II. 55-60); regarding Claim 16, the reference discloses that valves have been formed of steel (col. 1, II. 30-35); and regarding Claim 18, a metal oxide, Al<sub>2</sub>O<sub>3</sub>, is part of the composition of the intermediate layer (col. 8, II. 45-50).

In response, Applicants submit that these dependent claims are allowable by virtue of their dependency from allowable (amended) claim 1.

Accordingly, withdrawal of the rejection is respectfully requested.

#### **Claim Rejections - 35 USC § 103**

Claim 17 (wherein the at least one intermediate layer comprises an Ag-based alloy and/or Ni-based alloy and/or Ti-based alloy and/or a Cu-based alloy) is rejected under 35 U.S.C. 103(a) as being obvious over Koike et al. (U.S. Pat. No. 5,076,866) in view of Takano et al. (U.S. Pat. No. 6,131,603).

According to the Examiner, the primary reference teaches all of the limitations as described in the parent claim, but fails to disclose an intermediate layer comprising an Ag, Ni, Ti, or Cu based alloy.

Takano et al. is cited for disclosing a poppet valve having undergone surface treatment. The various stages of surface treatment create layering affect of a titanium based alloy material (col. 1, II. 59-61) at areas where the valve is induced to stress forces. At the time of the invention, it would have been obvious to one of ordinary skill to

incorporate the use of a titanium based alloy in a layered arrangement. The motivation to combine relies on the need to increase a structures wear resistance without increasing its rigidity.

Applicants respectfully submit that Takano neither teaches intermediate layers, nor the selected chemical joint enhancing alloys of the present invention.

Claim 19 is rejected under 35 U.S.C. 103(a) as being unpatentable over Koike et al. (U.S. Pat. No. 5,076,866) in view of Esswein et. al. (U.S. Pat. No. 7,401,586).

The primary reference discloses all of the limitations as described in the parent claim, but fails to disclose a layer with an open porosity between 1% and 75%. Esswein et al. is cited for disclosing valve seat rings possessing a spray on alloy layer. One of the layers is described as having a microstructure with an open porosity of less than 5% (col. 3, ll. 40-45). It would have been obvious to one of ordinary skill in the art to incorporate the use of a material layer with an open porosity between 1% and 75% within an internal combustion engine valve component. The motivation to combine relies on the need to increase wear resistance on the structure.

In response, applicants submit that the overlap area of the valve head and valve stem, which in accordance with the present invention is subjected to enhanced chemical bonding, is not a part of the valve subjected to wear, thus any motivation to increase wear resistance is not relevant to the present claims.

Withdrawal if the rejection is respectfully requested.

## **Conclusion**

The Examiner cites the following prior art not relied upon is considered pertinent to applicant's disclosure:

- a. Bonesteel et al. (U.S. Pat. No. 6,263,849) discloses a similar valve structure to that of Claim 11.
- b. Ruhland et al. (U.S. Pat. No. 6,453,867) discloses a similar valve structure to that of Claim 11.

Applicants have considered these references and find no relevance to the present

Application No: 10/570,030  
Amendment A  
Reply to Office Action Dated October 15, 2008

Attorney Docket No: 3926.242

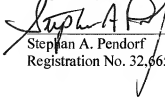
invention.

The Commissioner is hereby authorized to charge any fees which may be required at any time during the prosecution of this application without specific authorization, or credit any overpayment, to Deposit Account Number 16-0877.

**Should further issues remain prior to allowance, the Examiner is respectfully requested to contact the undersigned at the indicated telephone number.**

Patent Central LLC  
1401 Hollywood Blvd.  
Hollywood, FL 33020-5237  
(954) 922-7315

Respectfully submitted,



Stephan A. Pendorf  
Registration No. 32,665

Date: **January 15, 2009**